

USAWC STRATEGY RESEARCH PROJECT

**A REVIEW OF ACQUISITION FOR TRANSFORMATION, MODERNIZATION, AND
RECAPITALIZATION**

by

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ABSTRACT

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The Department of Defense requires an integrated process to determine how/when to make decisions about transformation, modernization, and recapitalization. Arbitrary timelines are an inadequate approach. Future Force capabilities should be incorporated into the force as they are operationally required, technologically feasible, and fiscally affordable. Such decisions are directly related to the modernization and recapitalization of extant systems. Additionally, these decisions are affected by the budgeting process, force structure changes, and the procurement process.

In light of the on-going transformation activities, we review the concerns of a too slow procurement process, an aging equipment set, and a shifting budget. We examine the defense budget cycle, changes to the composition of the defense budget, and decisions regarding budget allocations. We then survey a number of potential enhancements to the modernization, and recapitalization processes and follow with a review of recent improvements in the procurement processes and offer additional recommendations for improvement focusing on acquisition process changes, education, process monitoring, and administration.

A REVIEW OF ACQUISITION FOR TRANSFORMATION, MODERNIZATION, AND RECAPITALIZATION

Three on-going initiatives are updating the United States' (U.S.) military's systems and equipment: modernization, recapitalization, and transformation. The military requires an integrated process to determine how and when to make decisions about the three. Arbitrary timelines are an inadequate approach. Future Force capabilities should be incorporated into the force as they are operationally required, technologically feasible, and fiscally affordable. Such decisions are directly related to the modernization and recapitalization of extant systems. Additionally, these decisions are affected by the budgeting process, force structure changes, and the procurement process.

The Department of Defense's (DoD) acquisition process has been under fire for many years. There are frequent complaints that it takes too long to purchase equipment or systems. In a related vein, one hears with consternation that the average age of military equipment is on the rise and will only continue to rise. This seems contradictory when noting that the defense budget has been expanding over the past several years. How do we reconcile these three items and, more importantly, how do we improve on the acquisition process and reduce equipment age while not increasing and potentially working with a decreased budget? Further, this all must be done within the context of transformation and while actively fighting the war on terror.

After providing background on the length of the acquisition process and the age of military equipment we examine the budgeting process. We then define transformation, modernization, and recapitalization and the problems associated with each. We provide recommendations for alleviating the problems associated with modernization and recapitalization and finish with recommendations for alleviating problems with the acquisition process.

Background

At a recent conference, a number of senior military leaders complained that the acquisition system has not evolved to meet the demands and timelines now required for equipping warfighters.¹ One general stated: "Traditional acquisition isn't working" while another noted that it takes "six years to field a new system when technology changes every 18 months."² While six years may appear to be quite lengthy, this is actually a significant drop from the historical average of 11 years for major defense acquisition programs,³ considering some acquisition programs were taking as long as 15 to 20 years.⁴ While the noted reduction is significant, if one examines industry figures, it is clear that the DoD should be able to do better: in 2003, industry acquisition times were 18, 24, and 70 months for commercial spacecraft,

automobiles, and commercial aircraft, respectively, while DoD acquisitions were averaging 102 months.⁵ Regardless of rapid electronics changes, the military is involved in a war. Fielding of equipment after a six-year acquisition is too late to meet current needs.

Numerous studies have examined the average age of various military platforms and commented on the increasing average age of many of the U.S.' military's systems. Various Air Force and GAO reports in the past five years have noted that the average age of airframes is at an all time high, retirement age is increasing, and both of these are only expected to continue to increase.⁶ One Air Force journal article states: "The service's aircraft will continue to age dramatically: If all existing acquisition programs are executed as planned, the average USAF aircraft by 2020 will be 29 years old--meaning that for every airplane fresh off the assembly line there will be another that is 58 years old."⁷

A 2004 RAND study noted the same trends for Army equipment while studying the effects of age on equipment, in particular the M1 Abrams, to quantify maintenance and fiscal costs.⁸ One source cites former deputy undersecretary of defense for logistics and material readiness Roger Kallack as exclaiming "platforms [that are] more than 30 years old and ... programmed to remain in active service as much as 40 additional years--70-year-old platforms!"⁹

Aging equipment and aircraft generally means increased maintenance hours and costs and a reduction of mission capable rates, although not in all cases.¹⁰ Some tactical Navy aircraft do not show a predictable trend in mission-capable rates.¹¹ This fact is indicative of another problem: there has not been enough research to be able to reliably predict the effects of aging. Much may be known regarding a specific piece of equipment or about particular materials, but not enough is known about all of the components or materials that comprise military systems and platforms.

Compounding the aging problem is the extended usage being experienced by platforms in the War on Terror. There are reports that the Army's equipment is wearing out anywhere from five to 10 times as quickly as in peacetime¹² and General Schoomaker stated in June 2005 that the rate was between three and 10 times faster.¹³ Heavy trucks and tractors are logging 80,000 miles a year instead of the anticipated 8-10,000 miles.¹⁴ This will lead to a requirement to replace equipment at a greater than forecast and budgeted rate. The 2001 Quadrennial Defense Review (QDR) sums up the situation: Overall there is an imperative for recapitalization of legacy systems by replacement, selected upgrade, and life extensions."¹⁵

What is Happening with the Budgeting Process?

Since 1997 the DoD has received increasingly larger budgets. It "experienced a 4% growth rate in constant (inflation adjusted) dollars from fiscal year (FY) 1997 through 2001"¹⁶ not including Supplementals or contingency funds. From 2001 to 2005 the defense budget increased annually by 7% and defense spending overall has increased by 26%.¹⁷ While this would appear to be significant, it is worth noting that these increases still represent less than 4% of the U.S.'s Gross Domestic Product and come after numerous years of limited defense spending. In 1991 the DoD discretionary budget was \$319 billion, but did not pass that level again until 2002.¹⁸

Supplemental appropriations alleviate some of the stress of attempting to transform and modernize while executing on-going wartime operations, but one cannot expect that these will continue indefinitely. The DoD will need additional funding beyond the end of the war to continue its processes: "[If operations in Afghanistan and Iraq ended today] it [would] take us at least two years to reset the force..."¹⁹

In addition to the general complaints that the system is too slow, equipment is aging too fast, and money is too limited, there are a number of strategic issues surrounding the defense budget. One U.S. Army War College paper terms this a "strategy-resource mismatch."²⁰

Strategic defense budget challenges include:

- Cyclic defense budgets;
- Ratio between discretionary and mandatory portions of the federal budget; and
- Decisions about spending priorities.

We briefly discuss each and then focus attention on the final challenge.

An examination of the peaks and valleys in the defense budget provides insight into the issues facing those who are trying to pay for systems maintenance. It can be assumed that peaks in procurement funding imply increased numbers of fielded equipment and systems. As the equipment and systems age, maintenance funds become vital to their sustainment. Unfortunately the peaks in procurement spending have occurred in 1952, 1967, and 1985, while valleys in Operations and Maintenance (O&M) funds have occurred in 1961, 1975, and 1997.²¹ The valleys are between eight and twelve years after the procurement peaks. Considering the age of equipment, this implies that O&M funds may not be sufficient as defense systems age. Strategic planning for O&M funding appears to be lacking.

The nature of the federal budget has changed dramatically over the past thirty years. In 1962 the percentage available for discretionary items was at approximately 68% while

mandatory spending comprised the remaining 32%.²² In 2005 the discretionary portion of the federal budget had shrunk to only 37% while mandatory items constituted approximately 63% with an anticipated rise to 70% by 2012.²³ Mandatory items are primarily entitlements, which include Social Security, Medicaid, Medicare, and other retirement and disability programs. Entitlement items are not subject to congressional debate, which gives them: "an enduring quality that assures consistent, predictable funding over time – characteristics that are not common across the spectrum of the federal budget."²⁴ Discretionary funds "pay for such things as defense, transportation, national parks, and foreign aid."²⁵ These items come from the annual appropriation acts that are subject to congressional debate. The import of this is that the percentage of mandatory funds is increasing and is likely to continue to do so as the work force ages²⁶ and increased numbers of retirees place a greater burden on entitlement programs. This will leave proportionally less funds available for discretionary spending, of which the defense budget is just one piece. This changing and competitive nature of the budget presents a strategic challenge to defense planners.

The third defense budget challenge is that of decision-making about spending priorities. Defense leadership must properly scope the near, mid, and long-term threats, determine required capabilities to counter those threats, and define and shape the military forces to be able to defend against those threats while protecting the homeland. There are a number of national strategy documents that assist with establishing the guidelines for defining the required capabilities. Primary among these is the QDR. The QDR is a guide to modernization planning. The 1997 QDR laid out a strategy and set of priorities for achieving the vision of shape, respond, and prepare.²⁷ An U.S. Army War College paper provides an analysis of how well defense spending priorities corresponded with the stated vision. The author assesses that:

...the 1997 QDR failed to achieve the desired results in the three areas identified by the report as fundamental components of military power today and in the future. This strategy failure may or may not have been the result of a flawed plan, but it was certainly hampered by a defense program that did not adequately support the priorities established by the 1997 Review.²⁸

So, even though the priorities were established and stated, the DoD did not adhere to them.

The 2001 QDR gives a frank assessment of the current state of the military in which it notes that readiness is declining, equipment is aging, and the military is not dedicating enough resources to research and development.²⁹ One of the QDR's strategic tenets is "Transforming Defense."³⁰ Some guidance is given, including citing some specific systems for recapitalization: "...the Department plans to pursue selective upgrades to systems such as Abrams tanks, B-1 bombers, Navy ship self-defense, and amphibious assault vehicles..."³¹ Unfortunately, additional

guidance and priorities for recapitalizing and restructuring the force to achieve the capabilities needed to accomplish the goals of assure, dissuade, deter, or defeat is sparse.

Similar to the problem noted with the 1997 QDR, unless defense program planners are able to correlate their priorities directly to the 2001 QDR vision, there will continue to be a mismatch between strategy and resources. It is critical that defense leadership establish a long-term view to defining mission capabilities and correspondingly appropriate force size. They must appreciate the commitment required to stay on track and ensure stability. Further, leadership must seriously review the long-term priorities of prior leaders and understand the implications and repercussions when considering changing them.

In a related vein, when reviewing funding priorities, leadership must understand the implications of an unstable funding stream. An unstable funding stream frequently leads to a protracted production schedule. Lengthening the schedule enables funding for a system to be lowered on a per year basis. However, it has the side effect of increasing the overall funding expended as the per-item cost likely increases.

What is the DoD Doing to Fix these Problems?

We now take a more comprehensive look at the challenges of setting defense priorities and refining the acquisition and procurement processes. Enabling decisions about spending priorities includes an examination of information about the costs associated with equipment as well as capabilities data matched against capability requirements and needs. In order to set priorities, there must be a decision-making process to ascertain which equipment falls into which renewal bucket: recapitalization, modernization, or transformation. We define each of these activities and then address the questions, issues, and considerations that provide planners with the requisite background information such that they can determine which path is best suited for each system. We examine a number of techniques that the services can use to alleviate the issues and considerations associated with modernization and recapitalization. Finally, we examine the acquisition process and note a number of recommendations for improvement.

The DoD defines transformation as "a process that shapes the changing nature of military competition and cooperation through new combinations of concepts, capabilities, people, and organizations..."³² Modernization and recapitalization support transformation through equipment and systems improvements. Definitions given by the logistics community are:

Modernization: The *development and/or procurement of new systems* with improved warfighting capabilities.

Recapitalization: The *rebuild and selected upgrade of currently fielded systems* to ensure operational readiness and a zero-time/zero-mile system.

- Rebuild: Restores systems to a *like-new condition* in appearance, performance, and life expectancy; inserts new technology to improve reliability and maintainability.
- Upgrade: *Rebuilds system AND adds warfighting capability improvements to address capability shortcomings.*

Maintain: *Repair or replacement* of end items, parts, assemblies, and subassemblies that wear or break.³³

Modernization supports transformation through new purchases while recapitalization and maintenance support on-hand equipment. The decision to invest in modernization rather than continuing recapitalization or maintenance efforts is fraught with questions. These include such factors as life expectancy, maintenance costs, spare parts availability, technology obsolescence, etc. We next discuss some of the factors that impact on this decision.

As mentioned previously, the average age of equipment and platforms is increasing and based on current acquisition programs, will only continue to do so. The net effect of this aging is that readiness levels decline, the costs to maintain increase, and parts and systems are experiencing physical degeneration. These factors all impact on the decision as to whether to replace an entire system or to attempt to selectively rebuild, upgrade, or replace components.

Coinciding with equipment aging is the problem of acquiring spare parts. As time passes from the initial fielding, it becomes increasingly more difficult and expensive to purchase spare parts for systems. Part of the problem is that the parts may be either specific to a government piece of equipment (i.e., there are no or few commercial applications) or the government is or is becoming the only consumer still using the product. This means that there is an overall decreased purchase volume. With less demand, manufacturers will quit making the parts as it becomes increasingly cost inefficient for them to continue doing so, unless they are able to pass the costs along to the purchaser. The net result is that the government has decreased purchasing power, the number of manufacturers decreases, and competition decreases. This causes an increased price per item and prices that will continue to rise as the number of manufacturers decreases and volume of purchases remain (relatively) small.

A subset of the spare parts problem relates to various DoD initiatives to use commercial off-the-shelf (COTS) products to the maximal extent possible. COTS products can represent a low-cost solution if the product can be used directly or with inexpensive modifications. Purchase of an existing commercial product may save the DoD from having to expend resources to

develop its own solution where one already exists. However, it is typically the case that these products are not tested nor rated for the conditions in which the military operates, e.g., extreme high and low temperatures, rapid changes across a temperature range, sea air (humidity and salt), desert air (limited humidity and fine dust/sand), continuous use, vehicle shaking, etc. The modifications to make a ruggedized product may significantly raise the price of the product or may physically alter the product such that it is no longer feasible to use it in the intended manner.

Purchase of COTS products may incur an additional cost in the form of training and maintenance manuals if these are not readily available or must be adapted for the military usage. There is an overhead if these must be developed and fielded by the service. Finally, the commercial market may not have an enduring requirement for the product, which means it may have a short shelf life resulting in the potential for difficulty in acquiring replacements. All of these factors must be carefully weighed when examining a COTS product for incorporation into a military system.

A further subset of the acquisition of spare parts problem is the incorporation of commercial electronic parts into military systems. While the military used to be the leader in the development of electronic parts, this is no longer the case. Commercial electronics have a technology refresh rate that has dropped dramatically over time. These rates now typically range between 12 and 18 months, but may be less. Similarly, commercial software has releases that also have a refresh cycle. For Microsoft Office™, major releases are occurring at an average of around 28 months, while service packs for each product (e.g., PowerPoint, Excel, Outlook, etc.) are averaging two to three per product every eight to 12 months. Customer driven updates are running at a rate of approximately 100 per month.³⁴ Maintaining currency with each release/service pack/update of a commercial product requires a significant labor effort.

It is not uncommon for a commercial firm to no longer directly support older releases and for newer releases to lose backwards compatibility with older versions. Firms will cease making patches for their older versions as newer releases become more divergent from older versions. While there is no industry standard for categorizing software releases, many firms use the terms "retired," "mature," and "active." The only support for retired releases may be message boards or the like. Mature releases are those that are no longer being sold, but still receive some level of support. Depending on the vendor, patches or may not be written for newly identified problems, however, new features are typically not added to a mature release. Active releases receive the most extensive support.

For a military system that has an average life expectancy well beyond the timeline of two major version releases, backward compatibility and/or modularity become key considerations.

One example of this situation is the avionics found in the F-22 Raptor:

The F-22 Raptor program was begun nearly twenty years ago and is still at least five years away from fielding aircraft in squadron strength. Currently \$50 million a year is being budgeted to replace the 'old' F-22 avionics with new hardware and software. By the time the first production F-22 rolls off the line, its avionics systems will have undergone four refresh cycles.³⁵

Military systems will face obsolescence problems unless they somehow keep pace with hardware, firmware, and software improvements. To keep pace with current technology, military systems' design and/or procurement needs to change. Systems designers need flexibility in finalizing system specifications (establishing minimum requirements) until as late as possible, and they need to create modular designs that mandate technology refresh in software, firmware, and hardware.

Recent transformation initiatives have evolved the force structure. A decreased force size implies fewer systems are required. (Similarly, an increased force size would imply more required systems.) Decreased numbers of systems means a decreased volume of purchases with the net result being decreased government purchasing power. This can result in an increased price per system. Therefore, a decreased force structure does not necessarily imply a large reduction in acquisition funds. Second and third order effects must be accounted for when examining transformation initiatives.

Some key decisions have been made. Army leadership has "identified and prioritized 21 initial programs for recapitalization" along with a designation of the top 10 systems.³⁶ They set a recapitalization goal: "to maintain the average age of each selected system at or below half the expected service life for the system by 2010."³⁷ However, the Program Objective Memorandum (POM) budget for fiscal years 2002 through 2007 was short by about one third the amount needed for the Army's 21 recapitalization programs.³⁸ Although the funds covered about 75% of the programs, only two of the top 10 would have been able to achieve the Army's recapitalization goal. Therefore, additional measures must be taken to ameliorate the budget shortfalls.

Measures to help Alleviate the Problems Associated with Modernization and Recapitalization

A number of approaches exist that help to reduce the magnitude of the modernization and recapitalization funding concerns. As described above, using COTs products provides an alternative to system designs that use service-specific components, but COTs products must be

used with caution. Other approaches include designing/building families of systems (FOS) or systems of systems (SOS), and the processes of Unit Set Fielding (USF) and Software Blocking (SWB). OSD provides the following definitions:

A 'system-of-systems' may be physically bounded in a single platform or consist of a collection of separate, but interdependent, interconnected platforms performing different functions... A distinguishing factor for the 'system-of-systems' is that it depends on all its elements working interactively and continuously within a network to accomplish a pre-specified capability.

A 'family-of-systems' is a set or arrangement of independent (not interdependent) systems that can be arranged or interconnected in various ways to provide different capabilities....Thus, interoperability of the independent platforms is a key consideration in the ad hoc deployment of a 'family-of-systems'.³⁹

The benefit of these two approaches is that the defense acquisition system gains from a synergy in purchasing power: multiple related systems will reduce the individual price per system as the aggregate numbers of systems increase. This will further help O&M budgeting by lessening the impact of obsolescence of spare parts. By acquiring systems that are designed to be interoperable and must be somewhat modular, the Defense Department will gain when components age, wear, or fail.

Historically, systems have been delivered to the field as they were ready. Fielding dates did not necessarily coordinate well with the training of personnel to operate or maintain the system. The Army's standard fielding process evolved to the Total Package Fielding (TPF) process beginning in 1984. TPF was to integrate combat developers, material developers, trainers, and units into a more streamlined process.⁴⁰

The process of Unit Set Fielding has expanded on (although not eliminated) the concept of TPF. Both of these integrate all of the parties concerned with the fielding of a system, a family of systems, or a system of systems. Both take a holistic approach to the fielding of equipment in which the idea is to provide a unit with a new capability (or set of capabilities) rather than just a new system. MG Bond described USF to the House Armed Services Committee as the:

synchronization of individual system fielding plans into a single unit fielding schedule to streamline the fielding process... As part of a coordinated array, this disciplined modernization strategy goes beyond just equipping Army units. It also incorporates the manning, sustaining, training, organization and installation requirements to ensure that an increased capability is being fielded, and not just pieces of equipment.⁴¹

The belief is that this holistic approach will improve readiness by decreasing the duration and total amount of disruption experienced by units when receiving new capabilities. By no longer receiving each system along a separate timeline, all systems are integrated into a single

capability fielding timeline. It will "smooth out the readiness rating spikes and valleys associated with sequential fieldings resulting in a more consistent readiness rating."⁴²

The budgetary and acquisition benefits of USF include a more accountable method of tracking the fielding of new capabilities and a more stable and streamlined window for fielding. Using the USF approach, emerging technology can be inserted as ready and must not be fully developed when the first unit receives its systems. Additionally, risk can be spread across a number of years and units as technology evolves or matures. The idea is that USF "will also act as a major enhancement to system integration and, thus, promises to accelerate the force development process."⁴³

Complementing USF is the concept of Software Blocking (SWB). While the FOS and SOS policies tackle the broader approach to capability procurement, SWB is a parallel mechanism to match software development to capabilities. SWB empowers acquisition personnel with ability to *require* systems designers to build interoperable systems. SWB gives program managers the ability to require new systems with compatibility backwards to existing systems and compatibility forward by potentially increasing commonality across systems and generating synergistic functionality.⁴⁴

Additional modernization and recapitalization initiatives have begun over the past five years to address the aging problem for aircraft. The Aging Aircraft Integrated Product Team (AAIPT) under Naval Air Systems Command (NAVAIR) has reported on some of their processes.⁴⁵ There are a number of lessons learned that can be gleaned by observing their processes. Additionally, a Joint Council on Aging Aircraft (JCAA) was formed in 2002. The JCAA is an endeavor to review issues relevant to numerous agencies as aircraft continue to age. The JCAA drew members from all five services, government agencies (including the Defense Logistics Agency, Federal Aviation Administration (FAA), and National Aeronautics and Space Administration (NASA),) industry, and academia. Its charter has been to coordinate among the vested parties and to develop a strategy, prioritized roadmap, and an investment plan.⁴⁶ Among their twelve focus areas, relevant key initiatives for modernization and recapitalization include "Analytical methods/Cost of Aging," "Transition of Commercial Products," "Obsolescence Management," "Avionics Modernization," and "Component Improvement." Other DoD programs should investigate the combined lessons learned from these two initiatives:

- Examine and leverage technologies being developed for other systems; this requires research into whether there are other agencies with similar technology requirements.

- Locate other agencies that are encountering similar maintenance or obsolescence problems. Try to adapt those solutions to minimize research and development costs.
- Weight the benefits of pooling funding resources on common problems. This may create a "critical mass" in the research area.
- Explore dual-use funding options, e.g., AAIPT was able to receive funding from the FAA and other Air Force programs to develop solutions to a problem encountered by multiple agencies.⁴⁷
- Being able to speak with a single, dominant voice "makes for a stronger argument on Capitol Hill when asking for funding."⁴⁸
- Conduct analysis of the system to explore whether a modular solution might apply. To tackle the problem of replacements for aging and/or obsolete technology one engineer conducted a "detailed engineering analysis of the microcircuits involved" in a particular radar system.⁴⁹ That analysis led to new "drop-in" components. Additional benefits were leveraged from this analysis as the new components were applicable to other systems.
- Being joint improves the ability to leverage funding, research developments, and lessons learned from across the breadth of the DoD community.
- Include additional partners by drawing from the industrial base and academia. Leverage research and solutions from a wide variety of backgrounds. By "casting a wide net" you increase the potential for finding a solution as analogous problems may exist in other domains.

One novel approach toward alleviating the modernization and recapitalization problems has been proposed by Sheila Ronis.⁵⁰ Contrary to popular thinking, her suggestion is to spread system acquisition over a greater number of years (rather than a lesser number). In addition, her approach is to build a plan that replaces technology within all of the fielded systems on a regular, recurrent basis. As systems age, sell the oldest ones to foreign countries or commercial companies. The benefits of selling the oldest systems are that the funds could be used to offset the costs of newer systems, the U.S. inventory average age stabilizes, overall maintenance costs decrease, and instead of offsets to foreign countries that assist with developing their production or technology capability, use the offsets to assist with U.S. maintenance and modification activities. Ronis argues that this concept also leads to level and stable development and production funding over a longer period, which would be advantageous for the government and industrial base. She acknowledges that there would be an initial higher price per system, but that that the stability gained and the maintenance costs not expended for an

aging fleet would offset that price. She also contends that this process would enable the U.S. to keep its own fleet at the forefront of technological advances by facilitating a spiral development process.

Measures to help Alleviate the Problems Associated with the Acquisition Process

In addition to the budgetary considerations, an additional strategic challenge framing the transformation, modernization, recapitalization problem is the existing set of procurement mechanisms. As described above, it is claimed that the procurement system does not adequately meet the needs of the services. The 2001 QDR called for instituting a program to "modernize DoD business processes and infrastructure."⁵¹ It outlined efforts to:

- Streamline the overhead structure and flatten the organization;
- Focus DoD "owned" resources on excellence in those areas that contribute directly to warfighting;
- Modernize the DoD-wide approach to business information; and
- Consolidate and modernize DoD facility infrastructure.⁵²

Numerous studies have tackled acquisition reform. In 2002, the Undersecretary for Defense Acquisition, Technology, and Logistics, Edward "Pete" Aldridge, reported that DoD had conducted 128 studies on acquisition reform.⁵³ During the past few years a number of U.S. Army War College Strategic Research Papers (SRPs) have examined the Army's acquisition process. None made an assessment of the efficacy of the overall Army policy or of the viability of doing a total revamp of the overall acquisition and procurement policies and systems. This is most likely because the DoD released two new policies in May 2003: Directives 5000.1 *The Defense Acquisition System* and 5000.2 *The Operation of the Defense Acquisition System*.⁵⁴ These latest policies are the third such change in less than 15 years.⁵⁵

The SRPs found a number of process improvements that have been made in recent years and gave additional recommendations for refining and enhancing the procurement and acquisition processes. Major conceptual changes leading to improvements in the acquisition process include introducing the evolutionary acquisition (EA) methodology that uses a spiral development cycle, integrating low-rate initial production (LRIP) thresholds, incorporating cost as an independent variable (CAIV) for accounting, and increasing the amount of collaboration among the various interested parties. Each of these is briefly discussed next followed by a number of recommendations to further improve the efficacy of the acquisition process.

A significant improvement was the introduction of the Evolutionary Acquisition process.⁵⁶ EA is a spiral development of capabilities. More and more capability is developed through a

series of increasingly capable prototypes until the final system is developed and fielded. EA permits fielding of an initial capability without waiting for full system development. Interim capabilities are fielded dependent upon the maturation of technologies. EA enables course corrections throughout the development and fielding process as additional capabilities are completed, newer technologies matured, and input and feedback from the field are identified and incorporated. This final point is significant in that end-users are able to influence both a system's interface and its capabilities over the life of the program. This means that there will not be an all-inclusive requirements specification prior to system design, which may seem like a negative feature. However, this gives Program Managers (PMs) the flexibility to modify a system based on unanticipated user feedback or a changing environment.

Integration of Low-Rate Initial Production (LRIP) into the development strategy⁵⁷ was a second process improvement. This is essentially a sanity check on a system's utility while limiting production to less than 10% of the final number of systems. Evaluation of risk is required when a PM wants authorization for greater than 10% of the total procurement. The risk that the capabilities developed will not meet or exceed needs and a larger than normal initial production set has been purchased. On the other hand, the LRIP process creates a tension between bulk purchases and limited objective quantity buys. The former reduces individual item costs while the latter reduces risk by ensuring initial operating capability goals are met before making larger volume buys. PMs must understand and consider these tradeoffs.

A third process improvement was the incorporation of a new cost accounting definition: Cost As an Independent Variable (CAIV).⁵⁸ The objective of this improvement was to more accurately reflect total system costs and to associate this cost with known or expected capabilities. The idea was to move away from costing to match the budget, which has clearly not worked based on complaints about cost overruns, and towards a more holistic projection of cost. CAIV includes such factors as technology refresh, timeline, and maintenance.

Another process improvement was two channels of increased collaboration. The first was the amount of discussion between the government and potential bidders prior to the formal Request For Proposal (RFP) release.⁵⁹ The objective was to better educate both the buyer and the seller before making a procurement. By increasing the amount of communication and creating an atmosphere of openness, this initiative enables potential bidders to better understand the requested capabilities, timeline, and budget the DoD is soliciting. It enables the PM to better understand current technological capabilities (as well as shortfalls), recent and potential advances, and feasible development timelines, costs, and risks. The combined result

is that expectations for current and future technologies and capabilities can be more closely aligned at a reduced frustration level.

The second set of collaborative activities has been among the set of key government stakeholders.⁶⁰ While the PM is ultimately the responsible party, there are numerous other parties with vested interests. Empowering these parties by bringing them more closely into the acquisition process brings more minds to bear on solution generation and increases the likelihood that the product/system will meet needs and expectations along more dimensions (e.g., cost, utility, timeliness).⁶¹

While the conversion to a capabilities based approach to define requirements and a move to the FOS and SOS approaches for systems development are not direct measures to increase the speed of the acquisition and procurement processes, they do provide several advantages. The impact that these approaches have on the modernization and recapitalization processes bleeds over in to the requirements placed on the acquisition process. For example, FOS and SOS acquisitions can become a single line item in the budget. This creates a challenge to Congress, should they desire to change portions of the procurement. At the same time, using a single line gives the PM great flexibility by enabling the shifting of funds among the family or systems as mission requirements dictate.⁶²

The above conceptual changes have resulted in improvements, however there are still many additional measures that can or should be taken to further improve the acquisition process. These fall into the general areas of **process change**, **education and process monitoring**, and **administration**. Specific suggestions within each of these areas are given next.

Process Change. This set of recommendations calls for changing the process or the definitions it uses. The first recommendation is to change the definition of cycle time to include pre-acquisition and production time to make it a more honest measure.⁶³ Calculating the acquisition cycle time depends its definition. Some definitions of acquisition have included development as well as deployment timelines. Additionally, when a program is extended due to budgetary constraints, it likely will decrease annual production rates and slow the fielding rate. These schedule changes impact the acquisition timeline, through no fault of the acquisition process. A standard, accepted practice needs to be put into place.

Separate technology development from product development.⁶⁴ Defense systems are well documented as accepting greater risk during system development than are commercial industries. Increasing the amount of overlap in the research and development processes means a decreased time for technology maturity before it is to be inserted into a product. This "shift to

the left" for technology insertion increases the risk that the technology will not be sufficiently mature in time for insertion and creates a greater risk for cost overruns.

Related to the recommendation of separating research from development processes is a recommendation that defense acquisition plans increase the Technology Readiness Level (TRL)⁶⁵ of components before including them in a system design. The recommendation is to shift from a TRL of five or six up to seven or eight before including the technology in a development schedule. This is based on the industry practice of including new technology in a development schedule after it has reached a maturity of TRL seven or eight. This shift would lower the risk of cost or schedule overruns. If the DoD is going to accept a higher degree of risk than does industry, then PMs should also develop mitigating strategies for this risk.

Education and Process Monitoring. This set of recommendations strives to use the existing process, but with more wherewithal. It suggests areas of focus and provides some insight into means to better use the existing mechanisms.

DoD needs to better train its personnel on the EA process and DoD directives 5000.1 and 5000.2. A number of authors have asserted that not enough DoD personnel know and understand the processes that are articulated in these new directives. Without a comprehensive training program it is easy to understand the erosion of the overall acquisition process knowledge base due to the number of major process changes during the past 15 years. In addition to training on the basic directives, one recommendation was for training on topics of particular concern to contractors, for example, intellectual property rights, public disclosure of proprietary information, and understanding the nuances of the various contract options available.⁶⁶

Acquisition personnel need to better understand the key concepts and steps in the EA process. Several key analysis steps, in particular, were noted as being improperly or minimally done. This calls for additional training. The fundamental concept in the EA process – iterative spirals where capabilities increase with each new spiral – was not universally well understood. A related recommendation was to ensure that capabilities and requirements were not all front-loaded during EA product development.⁶⁷ The benefits of using a spiral development process, where features and technology are added in iterations, are lost when too many capabilities are placed in the first spiral. Spreading features and technology among the spirals reduces risk as less mature (yet promising) technologies gain time for advancement. Using the spiral process permits deferral of some design decisions until feedback is received through extensive user employment of the system. PMs need to understand the benefits to be gained through using this

iterative development process so they can better monitor the volume of features and technology insertion through each spiral.

In addition to the executors of EA programs, it was recommended that systems purchasers and end users be educated in the EA approach. Purchasers need to understand the implications of funding changes on the EA approach. They need to appreciate the implications of iterative technology insertions and of the potential for user requirements to change over time, thus impacting the design.⁶⁸ Raising awareness of technology evolution and changing user needs, and how these both impact on an EA solution, will reduce friction later.

End users need educating on the EA process in terms of expectation management.⁶⁹ Products developed using a spiral development process initially will not have full operational capability (FOC); full capability is achieved through successive spirals. Most end users expect to receive FOC upon initial product release. This can lead to tension between the fielding agency and the end user. Explaining to the end user that what they are receiving may not be the final product and that their input can help build a better future product gives these personnel ownership in the process and sets appropriate expectations for product capabilities.

A process step highlighted for additional training was on a methodology to comprehensively calculate COTS life cycle costs. As described earlier, integration of COTS products may be feasible to provide an existing technology solution. However, PMs must have enough information to realistically examine the life cycle cost of COTS products. The concern is over inclusion of COTS products that might become obsolete in a military system that has a long life cycle.

Another process step requiring additional attention was the use of Analysis of Alternatives (AoA). The recommendation was to ensure that an AoA took place prior to initial operating capability (IOC).⁷⁰ This ties back in to the collaboration and assessment activities prior to the RFP when both buyer and seller are comparing and evaluating capabilities, timelines, risk, and cost. Continued assessment and reassessment of government needs against technology maturity and risk will improve the quality and success of an acquisition.

Other recommendations to expand the knowledge base include exposing personnel to business practices and methods that enable acquisition success, i.e., lessons learned, and facilitating the sharing of these practices, e.g., creation of a collaborative web space along the lines of companycommander.com. Along the theme of collaboration is the recommendation to conduct a review of adjunct programs when changes are deemed necessary.⁷¹ Similar to the benefits gained by forming a coalition to examine the aging aircraft problem, PMs and their staffs should be exchanging information about lessons learned so that all may benefit. An

additional benefit takes place when modifications to one program can be leveraged by another program. Similarly, if programs have interrelated issues and the staffs are exchanging information, then modifications to one can more easily permeate across all relevant programs.

Comprehensive training on the acquisition process would enable the acquisition community in taking advantage of budgetary leeway and process flexibility to make more rapid acquisitions. Many believe that the steps for more agile acquisition are already in place, it is a matter of better using the existing mechanisms to achieve the desired goal. There are several examples where individuals have championed efforts to take advantage of the new procurement directives. The Rapid Fielding Initiative (RFI) is one such example. It was not a formal part of acquisition reform, yet it has proven to be highly successful. Under this initiative, deploying Army Soldiers receive additional COTS gear that many had been purchasing. RFI was instigated by General Keane, Army Vice Chief of Staff, in 2002 as a directive to Program Executive Office (PEO) Soldier to fix the problem of Soldiers making out of pocket purchases for equipment that enhanced Soldier survivability.⁷² Once a list of core equipment was validated, the goal was to take under 45 days to get the initial set of equipment to the first brigade. Deploying Soldiers now receive their RFI equipment either in the States or before movement into a hostile zone. The keys to success in this case were terming the initiative as an "equipping" problem rather than as a "fielding" solution, which permitted following different procurement rules,⁷³ and the close coordination of the various stakeholders including the Department of the Army Headquarters, Army Budget Office, Army Test and Evaluation Command, Training and Doctrine Command, and Army Forces Command.

There are formal steps in the acquisition process that enable initiatives similar to RFI. They exist through Federal Acquisition Streamlining Act (FASA) of 1994 Sections 8104 and 8203, which give guidance and preference for COTS and Non-Developmental Item (NDI) purchases.⁷⁴ While the steps may already exist, it would appear that most acquisition professionals and program managers either do not or do not know how to take advantage of the flexibility that they have been given. Based on recurrent complaints about the lack of speed in the system, additional measures must be taken to educate those involved in the process.

Similar to the RFI initiative, in September 2004 Deputy Secretary of Defense Paul Wolfowitz created the Joint Rapid Acquisition Cell (JRAC).⁷⁵ He noted that field commanders engaged in a wartime effort were not receiving "timely, effective support," and stated that: "Congress has given the department authority and flexibility to meet many of these needs yet, all too often our organizations are reluctant to take advantage of them."⁷⁶ The objective of the JRAC is to formalize and speed up the process of acquiring equipment in support of the

requirements declared by operational commanders. The need for the JRAC will be reevaluated after three years. Perhaps the JRAC will institutionalize measures that raise awareness or clarify procurement and acquisition options.

One mechanism to reduce the gap between successful demonstration of a system and securing POM funding is to use Research Development, Training, and Education (RDT&E) funds. Prior to the JRAC, both the Army and Air Force each initiated a Warfighter Rapid Acquisition Process (WRAP). The WRAP enabled programs to receive funding as a prototype solution for up to two years. The utility of WRAP may become more visible and institutionalized as the JRAC explores additional options to speed the acquisition process.

Administration. This set of recommendations deal with the administration of an acquisition program. The first recommendation was to add descriptions of roles and responsibilities to DoD 5000.1. One author believes that a lesser degree of ambiguity in delineating responsibility is required.⁷⁷ Elucidating these items would reduce ambiguity and direct key stakeholders to execute their assigned responsibilities.

A second recommendation was to assign a PM to a product earlier in the acquisition process.⁷⁸ Too often a PM is brought in after many of the key decisions have already been made⁷⁹ and this individual will lack the insight that went into the various product design decisions. Assigning a PM earlier in the acquisition process will increase the government's knowledge base. Even if a program gets dropped, at least the decision to do so is informed by an educated party. This recommendation would require changes to the selection and management of personnel to act as PMs, currently a board-selected activity.

A third recommendation was to permit a PM to serve as the PM for longer than a standard military three or four year tour. This is a logical extension of the prior recommendation. It increases continuity and the knowledge-base that the PM, and hence the government, has. The implication of this recommendation is that either the military must not penalize PMs for their longevity in the same role or PMs must recognize that this may be a career-stagnating position.

A fourth recommendation was to reduce the set of documents required for a program review and streamline the entire process.⁸⁰ A major program review currently requires the generation of over 60 documents per DoD 5000.2. This is clearly a huge undertaking that should complement the development and production process rather than distract from it.

A final administrative recommendation was to decentralize responsibility for system acquisition. While guidance has called for decentralization of the acquisition process, quite the opposite has taken place. The number of required reviews at the OSD level has risen not dropped.⁸¹ There is concern that the number might further increase based on a 2003 General

Accounting Office (GAO) report.⁸² The overhead of preparing each review is significant and, as discussed above, is not likely to decline. This goes against the principle of decentralizing responsibility and streamlining the acquisition process.

Summary

Transformation, modernization, and recapitalization will only be successful if the processes, budget, and personnel are adequate to the mission. Changing to a capabilities-based focus and using the family and system of systems approaches along with unit set fielding and software blocking, requires transforming the acquisition process. Further, the evolutionary acquisition process with its tenet of iterative development combined with the sub-processes of LRIP and CAIV have altered the underlying paradigm of program acquisition. General exasperation with the entire process has led key leaders and some acquisition personnel to start working together to ameliorate the problems. The increased emphasis on jointness across the services likely has contributed to collaboration in ways that might never have occurred previously.

A significant number of authors have proposed a wide-range of solutions to fix various aspects of the problems associated with defense procurement, recapitalization, and modernization activities. These include process changes, increased education, improved process monitoring, and administrative changes. The volume of solutions is indicative of the complexity of the problem – no single solution will solve all of the problems. Should and can the defense community make wide, sweeping changes to enable reform, or are these processes so mired in tradition and culture that the only way to affect change is through piece-meal, incremental fixes? Based on the existence of current complaints, it would appear that the two major revisions to the Defense acquisition system over the past 15 years have not been sufficient. Whether they did not go far enough, lacked the muscle to implement, or are simply misunderstood is an open question. An additional explanation is that perhaps the changes are slow to show progress, but are indeed starting to take root and work. This is evident when considering that the average procurement timeline has dropped to less than half of its prior average and recent initiatives have fielded equipment in significantly less time. The question remains how to institutionalize these successes and approach industry timeline standards. Meanwhile, the number of suggestions and recommendations should be examined for applicability and where appropriate, incorporated or even expanded.

Endnotes

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